WETLANDS MITIGATION PLAN
IN RE: AI NO. 102827
STICE CREEK DRAINAGE DITCH
MARSHALL COUNTY, KENTUCKY
OWNERS: BILL BARRETT, WM. ROUSE, WM. WILSON, BURTON YOUNG, KENNETH DARNELL

NOVEMBER 2009

I. OBJECTIVES OF RESTORATION

The objective of this restoration is to restore wetland function, value, habitat diversity, and capacity to a close approximation of the pre-disturbance by:

1. Restoring hydric soil – restoration site will be located on hydric soil;
2. Restoring hydrology – the hydrology and hydroperiod of the restored site shall approximate the conditions that existed before alteration, work associated with the wetland shall not adversely affect adjacent properties;
3. Restoring native vegetation – where natural colonization of pre-identified, selected species will realistically dominate within 5 years, sites may be left to revegetate naturally. If a site has not become dominated by the targeted species within 5 years, active forms of revegetation may be required.

II. MITIGATION SITE SELECTION

Because of the minimal impact to the site and the watershed and the propensity of the site to restore functionality through natural processes as observed by representatives of the KDOW and the USACOE, this effort will entail a "Permittee Responsible" Mitigation Plan as defined by the USACOE:

> "Permittee-Responsible Mitigation": An aquatic resource restoration, establishment, enhancement, and/or preservation activity undertaken by the permittee (or an authorized agent or contractor) to provide compensatory mitigation for which the permittee retains full responsibility.

Although some aspects of the plan will require further soil disturbance, the minimal scope of the disturbance and the critical timing of the same is such as to preclude off-site and/or downstream impacts to water quality. No off-site mitigation is contemplated.

The physical site is situated on the west side of US Hwy. 641 North near the town of Gilbertsville. The site can be accessed via Hwy. 641N from Draffenville on the south end, or from Kentucky Dam on the north end. The property is located behind the Clean Earth Recycling and the Marshall County Garbage Collection Station at 6847 US Hwy 641N. Entry to the property is through an easement right of way along the northern property line of the recycling business.

III. RESTORATION SITE PROTECTION INSTRUMENT

The impacted site is owned in fee simple by the above-referenced tenants-in-common who will assume responsibility under the "Permittee-Responsible" mitigation plan. Furthermore, the entire site which contains the areas of interest to the mitigation plan are under perpetual easement in favor of The Nature Conservancy that precludes conversion of any part of the tract from the intended natural state.

IV. BASELINE INFORMATION
A. Pre-disturbance Impact Site Ecological Characteristics

1. The pre-disturbance impact site is less than 2 acres. It is situated on a 50 acre +/- tract near the community of Gilbertsville, Kentucky. The tract is bounded on the northwest by the Stice Creek Drainage Ditch, is bisected by the Kentucky Dam/Murray Transmission Line, and situated just north of English Road.

2. The soil in the impacted area is Waverly Silt Loam. The Waverly series consists of nearly level, very deep, poorly drained soils that have moderate permeability. These soils are on floodplains of streams that drain the Southern Mississippi Valley Silty Uplands Major Land Resource Area and on alluvial fans along the eastern edge of the Southern Mississippi Valley Alluvium Major Land Resource Area. They formed in silty alluvium derived from loess. Slopes range from 0 to 2 percent.

Of the two impacted "streams, the largest known as the Stice Creek Drainage Ditch is an artificial creek that appears on the US-TVA Land Acquisition Maps dating from the late 1930's. It drains an area along US 641 North into the Cypress Swamp. The course of the ditch is straight except for a 45 degree turn to the NW at the NW corner of the above-referenced property. The ditch is shallow and the flow is intermittent. Along the border of the referenced tract, the Ditch exhibits the characteristics of a lowland drainage canal, the banks of which range from 0 to approximately 2 feet in height. The width of the Ditch is most often defined by the deposits of spoil on either side that constitute a levee that ranges in height from 1 to 5 feet with instances of spoil piles of more than 6 feet. The bed of the Ditch ranges from multiple small sand/gravel beds of no more than 2 feet in width to smooth sand/silt beds of up to 20 feet.

For most of its length, the original channel of the Ditch in indiscernible except for the levees on either side. Where the levees have been removed or have washed away, the Ditch becomes shallow and spreads out into the surrounding wooded land. The flow of water along the Ditch is blocked by plies of woody debris, trees that have taken root in the original channel, and by numerous beaver dams.

The Ditch drains an area of commercial activity along 641 North before entering the Cypress Swamp. Along Hwy 641N, ditches have been cut at intervals that drain into the Ditch. The Ditch is dry for most of the season and has flow only during wet weather. There are a few pools along the ditch that have been formed behind beaver's dams. The pools are typically shallow and stagnate. The Ditch does not overflow its banks during periods of excessive runoff, but is itself inundated by the flow of water from higher elevations.

Because the Ditch is on the upper side of the Cypress Swamp, the elevation of the land continues to fall from the location of the Ditch to the remnants of Cypress Creek. During times of excessive rainfall, the Ditch is inundated by runoff from the higher elevations to the south and west. The runoff dissipates rapidly as the Ditch is on the high side of the Cypress Swamp. There is no backwater from either Cypress Creek or the Tennessee River that reaches the Ditch as it runs parallel to Hwy. 641N.

The intermittent flow and frequent dry periods prevent fish and other aquatic life from thriving in the Ditch. It is, however, home to snakes, frogs, lizards, and beavers. The land on either side of the Ditch is populated with bottomland hardwood species, primarily oak, hickory, and beech.

The second impacted "stream" is a combination drainage/borrow ditch that extends from a culvert under Hwy. 641N to the Stice Creek Ditch. This ditch is one of several ditches that extend from 641N to intersect the Stice Creek Ditch, dating from the construction of the Kentucky Dam Access Road in the late 1930's now known as

US Hwy. 641. As the bed of the Access Road was built-up across lower lying areas, runoff from the hills to the south and east was redirected and concentrated in a series of culverts extending underneath the road. From these culverts, ditches were cut to channel water into the Stice Creek Ditch.

The impacted stream #2 on the property is such a drainage ditch. Over the years, however, the castaway material from the ditch was built up to form a berm along the north side of the property for the purpose of impounding water to attract waterfowl. The berm was not intended to deflect water as it is on the downstream edge of the tract. There is no flow in stream #2 except during periods of wet weather and excessive runoff. Beavers have impounded several small pools along the length of the ditch which ranges in depth from 1 to 4 feet, and in width from 2 to 20 feet. The ditch is overgrown with marginal trees such as willow and sweetgum as the beavers continually remove trees along its length.

Near the intersection of this ditch with the Stice Creek Ditch, the channel is clogged with woody plant debris and beaver cuttings. During periods of excessively wet weather, the beavers raise dams along the length of this ditch and increase the height of the berm that runs parallel to the ditch.

The impacted wetland area was formed as a result of levee built along the Stice Creek Drainage Ditch and the berm formed along Ditch #2 which seasonally impounded water in what was once a lowland forest area on the lower end and agricultural fields on the upper end. The land extending in a southwesterly direction along the Stice Creek Ditch from the subject tract to Hwy. 641N is still actively utilized for agricultural purposes. The land immediately north of the subject on the opposite side of Ditch #2 was developed first as an aquatic theme park and has in later years become a commercial/residential subdivision.

3. Pre-disturbance vegetation on the impacted areas consisted of scattered early successional trees, primarily sweetgum, willow, maple, oak, and hickory. Open areas were populated with wetland grasses such as smartweed, bulrush, and cattail. Areas that held water on a seasonal basis were dominated by the smartweed.

4. The wetland classifications for the impacted areas are PFO1C (Palustrine, Forested, Broadleaved Deciduous, Seasonally flooded), and PEM1A (Palustrine, Emergent, Persistent, Temporarily flooded).

5. Wetland Functions
According to Technical Report WRP-DE-17, the Regional Guidebook for Assessing the Functions of Low Gradient, Riverine Wetlands in Western Kentucky, the functions are:

a. Temporarily store surface water – before disturbance, the subject was capable of temporary storage of surface water due to impoundment by berms and/or levees along three sides of the tract.

b. Maintain characteristic subsurface hydrology – before disturbance, the Waverly soil of the tract supported movement of subsurface water originating from direct precipitation, interflow (unsaturated subsurface flow), groundwater (saturated subsurface flow), and overbank flooding. This was evidenced by an elevated water table, occurrence of seeps, and low areas of standing water.

c. Cycle nutrients – defined as the ability of the wetland ot convert nutrients from inorganic forms to organic forms and back through a variety of biogeochemical processes such as photosynthesis and microbial decomposition. Simply stated, this process involves the cycling of nutrients within and among the soil, plants, animals, and dead organic matter. Pre-disturbance, the tract exhibited evidence that nutrients were being cycled based on observations of healthy plant life, a soil capable of decomposing and absorbing material, the presence of a variety of animals including invertebrates, and by the presence of detritus or plant tissue that has fallen to the ground.

d. Remove and sequester elements and compounds – the ability of a wetland to permanently remove or immobilize nutrients, metals, and other compounds imported from upland sources via overbank flooding.

Factors that influence this function include overbank flooding, depth of water table, soil clay content, and redoximorphic features of hydric soils. As explained in the guide, the processes necessary for this function are seldom affected by wetland impacts, but the method for delivery of elements and compound is typically altered. Pre-disturbance, the tract was available for delivery of compounds and elements via overbank flooding, had soil of sufficient clay content and cation exchange, displayed evidence of a seasonally high water table, and had a hydric soil implicit in reduction reactions.

e. Retain particulates –the capacity of a wetland to physically remove and retain inorganic and organic particulates originating from onsite or off-site sources. In western Kentucky, this function is dependent on frequency of overbank flooding, the storage volume of the wetland, the slope of the wetland, and topographical roughness. In the pre-disturbance condition , the tract was subject to frequent overbank flooding, had a storage capacity based on the effective height of the existing berms and levees, was subject to minimal slope indicative of riverine wetlands, and exhibited topographical roughness in the form of surface inundations, fallen trees and woody debris, and the frictional action of herbaceous plants – all elements required to retain particulate matter.

f. Export organic carbon – the capacity of the wetland to export the dissolved and particulate organic carbon produced in the riverine wetland. Mechanisms to promote this feature include the leaching of litter, flushing, displacement, and erosion. Riverine wetlands normally function as open systems because the wetlands occur in low areas adjacent to stream channels and because the wetlands are linked to stream channels through overbank flooding. The pre-disturbance condition of the tract had the ability to export organic carbon due to the frequency of overbank flooding and the subsequent movement of organic litter into and out of the tract by the flooding as evidenced by the presence of logjams and debris both onsite and off site, and the evidence of scouring and erosion of levees, berms, and surface areas.

g. Maintain characteristic plant community – the capacity of a riverine wetland to provide the environment necessary for a characteristic plant community to develop and be maintained. The quantity and quality of the extant plant community does not necessarily equate to the ability of the tract to maintain a viable plant community as other factors influence the growth rate of the extant plants. In the pre-disturbance condition, the tract supported a healthy plant community that was primarily early successional. This is due in large part to alterations and direct damage by beavers. Within the past decade, the mature woodlands both on and adjacent to the tract have been compromised by non-seasonal flooding from beaver impoundments and by girding and/or felling of trees by the beavers. Only a few remnants remain of the large cypress and hardwood trees that were once characteristic of the area. They have been replaced by species such as sweetgum, willow, sycamore, and maple resulting in a plant community more commonly associated with a semi-open wetland dominated by non-woody plants and grasses and fast-growing low-quality saplings.

h. Provide habitat for wildlife – the ability of the wetland to support the wildlife species that utilize riverine wetlands during some part of their life cycles. The site supports a wide range of animal life due to the variety of habitat including areas that are flooded most of the year, seasonally flooded areas, and areas of high ground that do not flood often. The pre-disturbance tract held populations of all wildlife typical of western Kentucky riverine wetlands.

B. Post-Disturbance Ecological Characteristics

1. No stream was altered in the action of "disturbance" or is proposed to be altered in the restoration plan. The amount of wetland altered by removing or deposition of fill was less than two acres.
2. Alterations to the wetlands included the placement of fill obtained from the wetland onto the tops of existing levees, construction of new levees using fill removed from the wetland, the placement of a water control structure, and the insertion of an 8 inch diameter steel pipe approximately 12' in length in a section of drainage ditch referred to as "Ditch No. 2" above. Further alterations will include the removal of the water control structure, the 8" diameter steel pipe, and the flattening of the new levee as conditions provide.

3. The existing on-site vegetation consists of early successional woody plants such as sumac, sweetgum, oak, hickory, birch, sycamore, maple, and willow, along with mature specimens of bald cypress. Herbaceous plants include cattail, bulrush, and smartweed along with yellow nutsedge. Areas adjacent to the tract contain both woody and herbaceous plants similar to the subject tract except that the dominant herbaceous plants on adjacent areas are fescue and bromegrass instead of smartweed and bulrush like the subject.
5. The wetland classification is unchanged from pre-distrubence.
6. Post-disturbance wetland functions:

a. Temporarily store surface water – before disturbance, the subject was capable of temporary storage of surface water due to impoundment by berms and/or levees along three sides of the tract. The post-disturbance tract will also have the capacity to store surface water contingent upon the integrity of the berms and levees in place. The effort to restore the tract to pre-disturbance condition will result in no net change to storage capacity.

b. Maintain characteristic subsurface hydrology – before disturbance, the Waverly soil of the tract supported movement of subsurface water originating from direct precipitation, interflow (unsaturated subsurface flow), groundwater (saturated subsurface flow), and overbank flooding. This was evidenced by an elevated water table, occurrence of seeps, and low areas of standing water. The action of restoring the tract to the pre-disturbance condition will not change the soil class or interfere with the movement of subsurface water, nor will restoration affect the frequency of overbank flooding.

c. Cycle nutrients – defined as the ability of the wetland to convert nutrients from inorganic forms to organic forms and back through a variety of biogeochemical processes such as photosynthesis and microbial decomposition. Simply stated, this process involves the cycling of nutrients within and among the soil, plants, animals, and dead organic matter. Pre-disturbance, the tract exhibited evidence that nutrients were being cycled based on observations of healthy plant life, a soil capable of decomposing and absorbing material, the presence of a variety of animals including invertebrates, and by the presence of detritus or plant tissue that has fallen to the ground. The restoration effort will not affect the decomposing and absorption ability of the soil, and will have temporary impact on plant life only in areas where the soil is actually moved. It is expected, however, that the plant regime on the impacted areas will replenish itself very quickly to resemble that of pre-disturbance.

d. Remove and sequester elements and compounds – the ability of a wetland to permanently remove or immobilize nutrients, metals, and other compounds imported from upland sources via overbank flooding. Factors that influence this function include overbank flooding, depth of water table, soil clay content, and redoximorphic features of hydric soils. As explained in the guide, the processes necessary for this function are seldom affected by wetland impacts, but the method for delivery of elements and compound is typically altered. Pre-disturbance, the tract was available for delivery of compounds and elements via overbank flooding, had soil of sufficient clay content and cation exchange, displayed evidence of a seasonally high water table, and had a hydric soil implicit in reduction reactions. The impacted area post disturbance will not alter the methods of delivery of elements and compounds as the flow of water into the wetland will not be further restricted.

e. Retain particulates –the capacity of a wetland to physically remove and retain inorganic and organic particulates originating from onsite or off-site sources. In western Kentucky, this function is dependent on frequency of overbank flooding, the storage volume of the wetland, the slope of the wetland, and topographical roughness. In the pre-disturbance condition , the tract was subject to frequent overbank flooding, had a storage capacity based on the effective height of the existing berms and levees, was subject to minimal slope indicative of riverine wetlands, and exhibited topographical roughness in the form of surface inundations, fallen trees and woody debris, and the frictional action of herbaceous plants – all elements required to retain particulate matter. The restoration of the tract to the pre-disturbance condition will not alter the ability of the tract to retain particulates as there will be no change in the frequency of overbank flooding, in the slope of the wetland, the storage capacity, or the topographical roughness.

f. Export organic carbon – the capacity of the wetland to export the dissolved and particulate organic carbon produced in the riverine wetland. Mechanisms to promote this feature include the leaching of litter, flushing, displacement, and erosion. Riverine wetlands normally function as open systems because the wetlands occur in low areas adjacent to stream channels and because the wetlands are linked to stream channels through overbank flooding. The pre-disturbance condition of the tract had the ability to export organic carbon due to the frequency of overbank flooding and the subsequent movement of organic litter into and out of the tract by the flooding as evidenced by the presence of logjams and debris both onsite and off site, and the evidence of scouring and erosion of levees, berms, and surface areas. Restoration of the wetland to the pre-disturbance condition will not diminish the ability of the tract to export organic carbon.

g. Maintain characteristic plant community – the capacity of a riverine wetland to provide the environment necessary for a characteristic plant community to develop and be maintained. The quantity and quality of the extant plant community does not necessarily equate to the ability of the tract to maintain a viable plant community as other factors influence the growth rate of the extant plants. In the pre-disturbance condition, the tract supported a healthy plant community that was primarily early successional. This is due in large part to alterations and direct damage by beavers. Within the past decade, the mature woodlands both on and adjacent to the tract have been compromised by non-seasonal flooding from beaver impoundments and by girding and/or felling of trees by the beavers. Only a few remnants remain of the large cypress and hardwood trees that were once characteristic of the area. They have been replaced by species such as sweetgum, willow, sycamore, and maple resulting in a plant community more commonly associated with a semi-open wetland dominated by non-woody plants and grasses and fast-growing low-quality saplings. The restoration effort to pre-disturbance condition will not affect the plant community as the soil of the tract has the ability to reseed itself quickly. Additionally, the areas disturbed during the restoration process will be very small and will involve the smoothing and leveling of existing fill rather than the introduction of new fill. Because the disturbed areas involved predominantly herbaceous areas, the restoration effort will not reduce the woody plant community. Again, the post-disturbance plant community will be limited by the continuing action of beavers which makes the introduction of new woody plant specimens impractical.

h. Provide habitat for wildlife – the ability of the wetland to support the wildlife species that utilize riverine wetlands during some part of their life cycles. The site supports a wide range of animal life due to the variety of habitat including areas that are flooded most of the year, seasonally flooded areas, and areas of high ground that do not flood often. The pre-disturbance tract held populations of all wildlife typical of western Kentucky riverine wetlands. The restoration of the tract to pre-disturbance condition will not reduce the quality or quantity of wildlife habitat.

5. Determination of Credits:

Since the objective of the restoration effort is to return the wetland to the pre-disturbance condition, there will be no net loss of wetland services and function as a result of the restoration.

6. Restoration Work Plan:

A. Construction methods – the restoration work will consist of the leveling and smoothing of the newly constructed interior berm, the removal of the water control structure, and the removal of the 8" diameter pipe in Ditch No. 2. Because the pre-existing levees have reverted to the pre-disturbance condition, no further impacts will be made.

1. This will be accomplished by use of mechanized equipment of appropriate size as to minimize damage to the surrounding land. As the interior berm is removed, the fill will be re-deposited into the area from where it was obtained. During this process, the water control structure will be lifted out of the berm and removed from the site entirely. The removal of the 8" pipe in Ditch No. 2 will be effected by removing the earthen-fill bridge that covers the pipe and placing the fill in the area from which it was obtained. The pipe will be removed from the area.

2. The leveling and effective removal of the interior berm will not require additional stabilization as the area is not prone to erosion. The fill will be re-compacted as soil conditions permit, and allowed to reseed naturally from the surrounding vegetation. The area disturbed by the removal of the 8" pipe is not subject to

active flow during the summer months and will require no stabilization other than smoothing and compaction. The footprint of this area is very small but will require reseeding with a blend of grasses approved for use in wetland areas.

3. The action of lowering the interior levee and the removal of the water control structure will maintain flow, such as it is, at pre-disturbance levels. The removal of the 8” pipe and the earthen bridge across Ditch No. 2 will remove any restriction to the flow of water through that ditch. Because these actions will of necessity be taken during the driest part of the year in which there will be little or no flow through the wetland or along the ditches, no additional action will be required to maintain flowage.

B. Schedule of Work:

1. The three elements of the work plan (removal of the interior levee, removal of the water control structure, and the removal of the 8” pipe), will be executed concurrently as long as soil conditions permit. Should soil conditions prove unsuitable for extensive exposure to mechanized equipment, the 8” pipe will be removed first as this task can be accomplished with a minimum of collateral disturbance.

2. The work plan will be timed so as to coincide with the driest period of the season, typically late August/September. It is our desire to commence the restoration action during 2010 as conditions permit. The work will not begin until soil conditions are firm enough to support the weight of the machinery. It will not be necessary to dewater the area during the restoration period. The area affected by the removal of the interior levee and the water control structure are not subject to excessive flow and should not require additional efforts to protect downstream water quality. The removal of the 8” pipe will not require additional downstream efforts because it is situated in a small ditch that has no flow during dry months. Additionally, the ditch is constricted by numerous beaver dams between the impact site and the terminus at the Stice Creek Drainage Ditch. During late summer, we do not anticipate flow sufficient to cause excessive erosion or degradation of downstream areas.

3. If soil conditions are not conducive to completion of the restoration project in 2010, we will so inform the Corps, the KDOW, and TNC, and will roll the plan into 2011 or whenever soil conditions permit.

7. Maintenance Plan:

After the restoration work is complete, we (the owners) will be responsible for monitoring the site for detrimental effect. If any of the impacted areas are slow to reseed naturally, we will reseed with a blend of grasses suitable for wetland habitats.

8. Performance Standards:

1. In the pre-disturbance condition, the area impacted by the construction of the interior levee was mostly level and covered by grassy vegetation typical of the adjacent area. On an annual basis, we will examine this area as restored to determine if the surrounding vegetation has successfully reseeded the affected area. If more bare dirt is visible on the affected area than on the adjacent non-disturbed areas, we will commence efforts to manually reseed the affected area with a blend of grasses suitable for wetland habitats.

2. In the pre-disturbance condition, the area across Ditch No. 2 with the 8” pipe was typified by various grasses and some early successional woody plants. On an annual basis we will examine the affected area to determine whether the initial reseeding effort has met with success. If more bare dirt is showing on the affected area than on the adjacent non-disturbed areas, we will commence efforts to bolster the establishment of grasses suitable for wetland habitat. Because of the likelihood of beaver damage and/or destruction, we will not undertake to reestablish woody plants but will allow native woody plants to propagate as they will.

3. And as required by the KDOW, we will complete the Wetlands Functions Checklist and Indicators of Function annually in the spring to achieve and maintain pre-impact condition.

9. Monitoring Requirements:

We will monitor the impacted areas for evidence of erosion and to determine the success of natural or manual replanting efforts. As suggested, we will establish monitoring stations on the 4 berms to be numbered 1 through 4, from which annual photos will be taken.

We will monitor the specific areas where restoration work was completed for the presence of invasive species (as noted on Kentucky's List of Invasive Plants), and will undertake to remove such plants with a method approved by TNC. We will conduct an informal survey of woody and herbaceous vegetation present on the areas where restoration work was completed in the fall of each year of the monitoring period and will provide a summary along with the annual report.

In accordance with RGL 08-03, compensatory mitigation projects typically have a monitoring period of 5 years. If the project has met its performance standards in less than five years, the monitoring period may be reduced at the discretion of the of the USACOE, provided there are at least two consecutive monitoring reports that demonstrate the success. A monitoring plan will be submitted annually to the USACOE and the KDOW by Dec. 31.

Additional monitoring will be conducted by TNC as part of their annual regime.

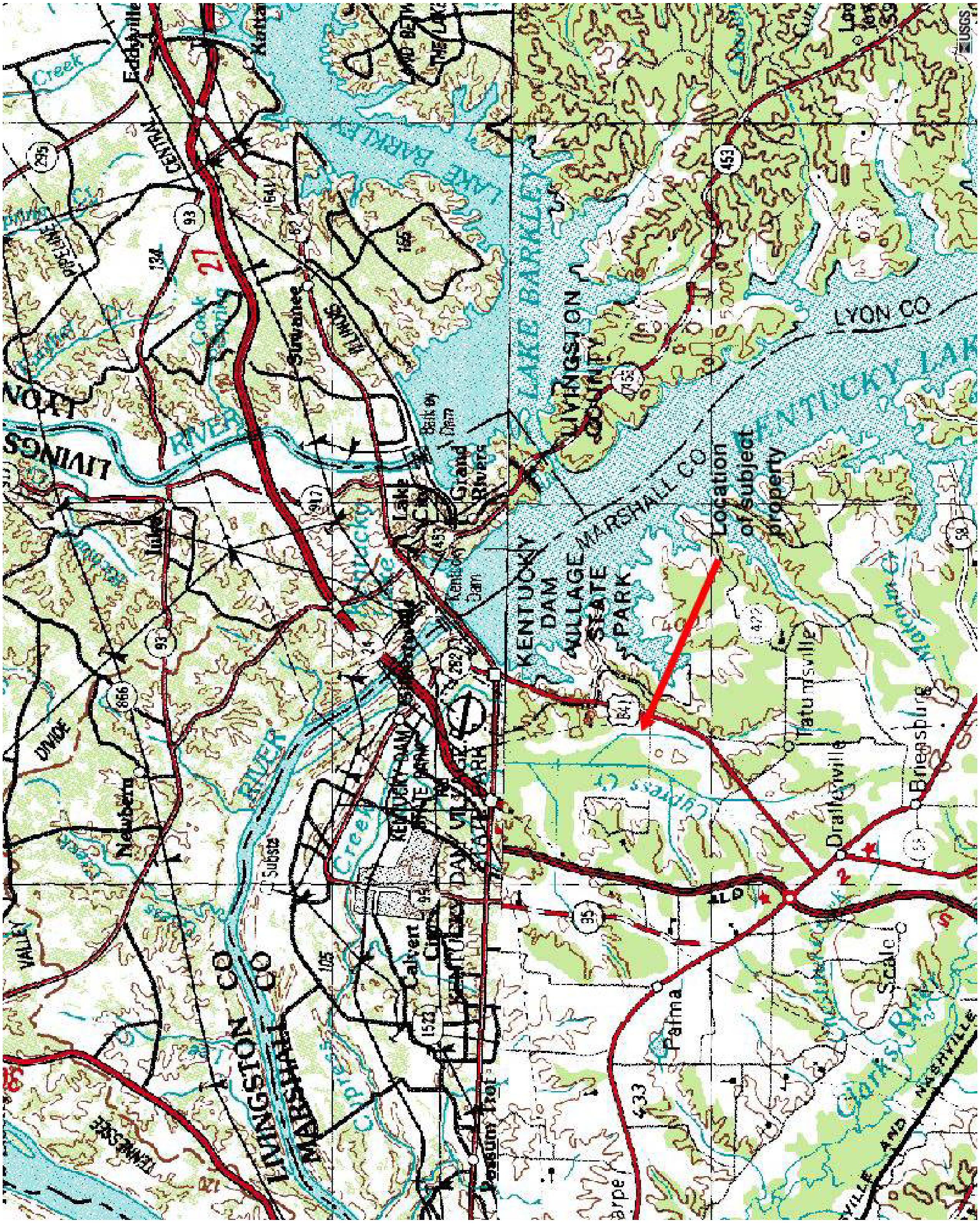
10. Long-term management plan.
After the performance standards have been achieved, we plan no further action.

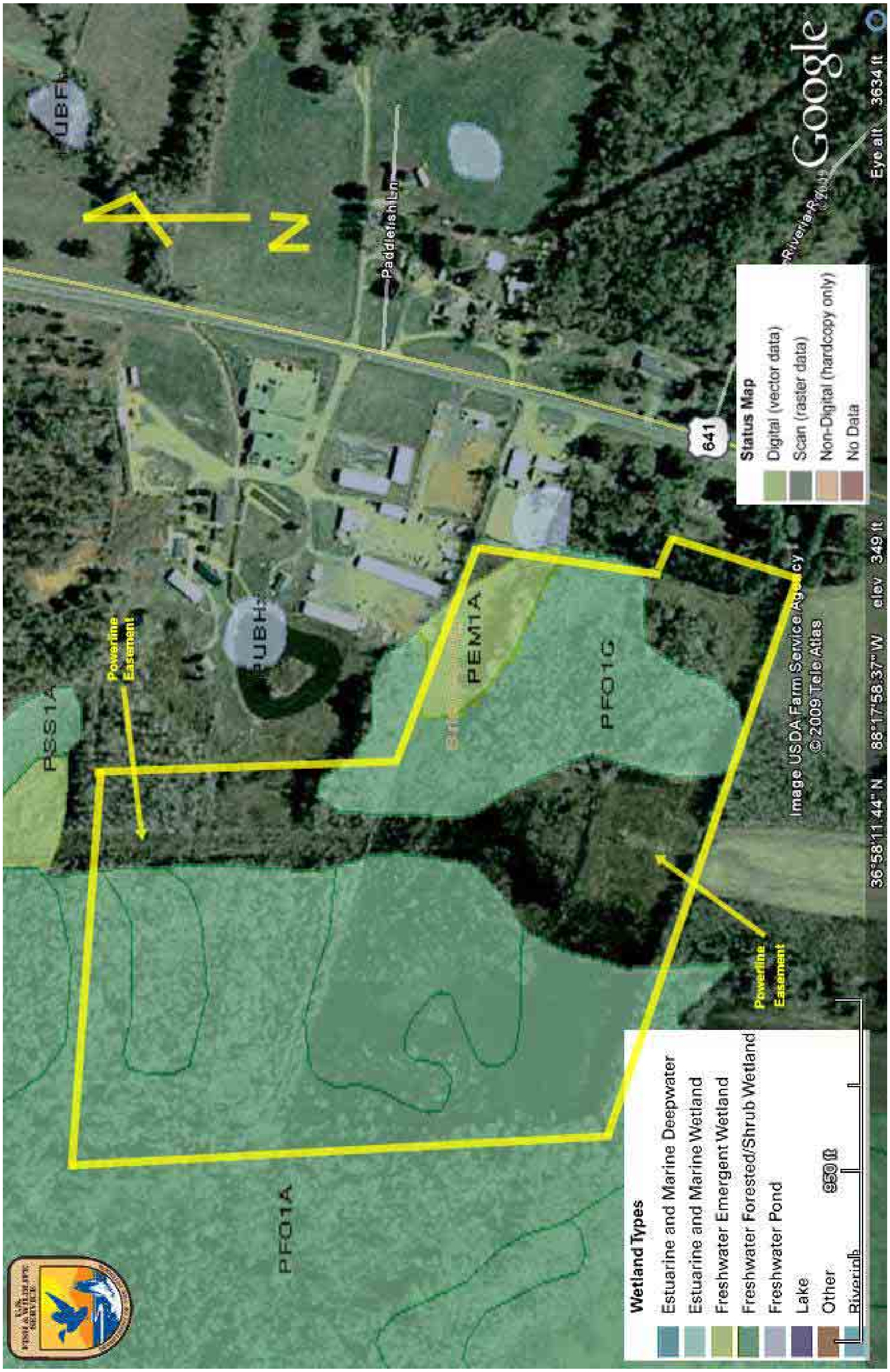
11. Adaptive management plan.
In the event of a change in ownership during the monitoring period, we will provide a written agreement that binds any new owners to the terms of the monitoring plan.

12. Financial Assurances:
The scope and impact of the project is not sufficient to warrant financial assurances.

13. Addenda

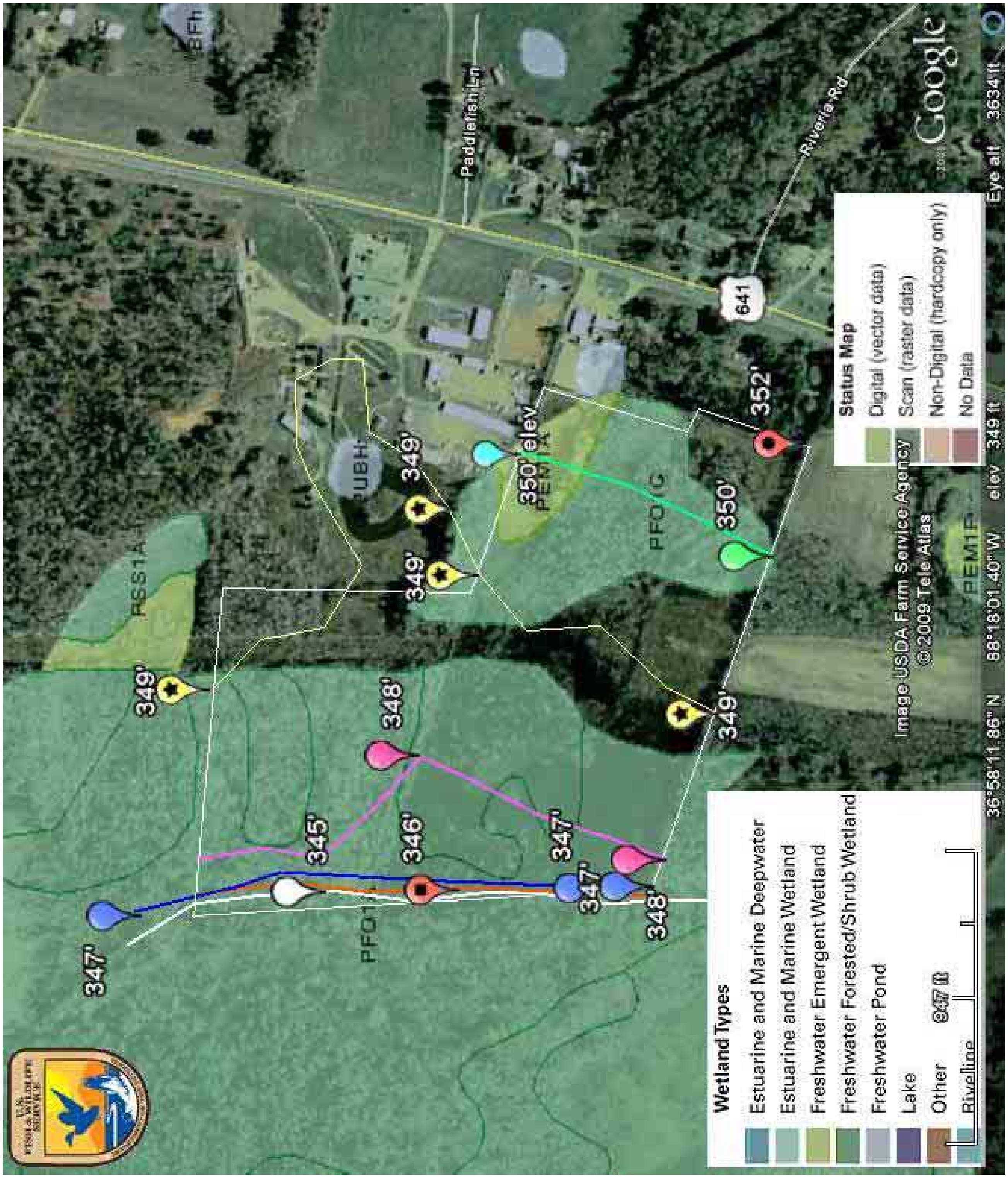
Contents of Addenda


Location of subject property
LAKE BARKLEY
LIVINGSTON COUNTY
LYON CO
MARSHALL CO
KENTUCKY DAM VILLAGE STATE PARK
LIVINGSTON CO
MARSHALL CO
Grand Rivers
Palma
Briensburg
Calvert City

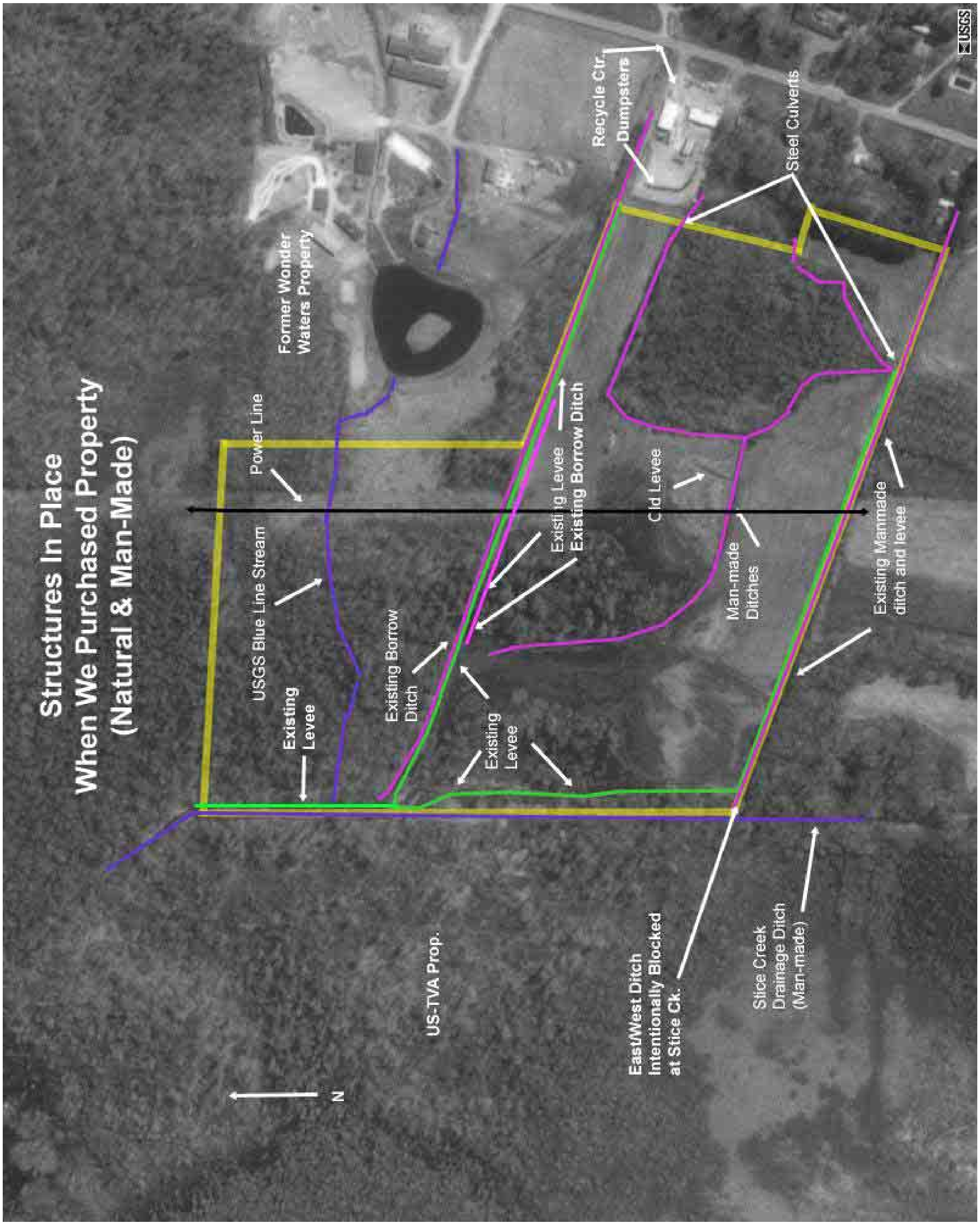


WETLAND DELINEATION MAP

USFWS WETLAND DELINEATION MAP W/ELEVATIONS

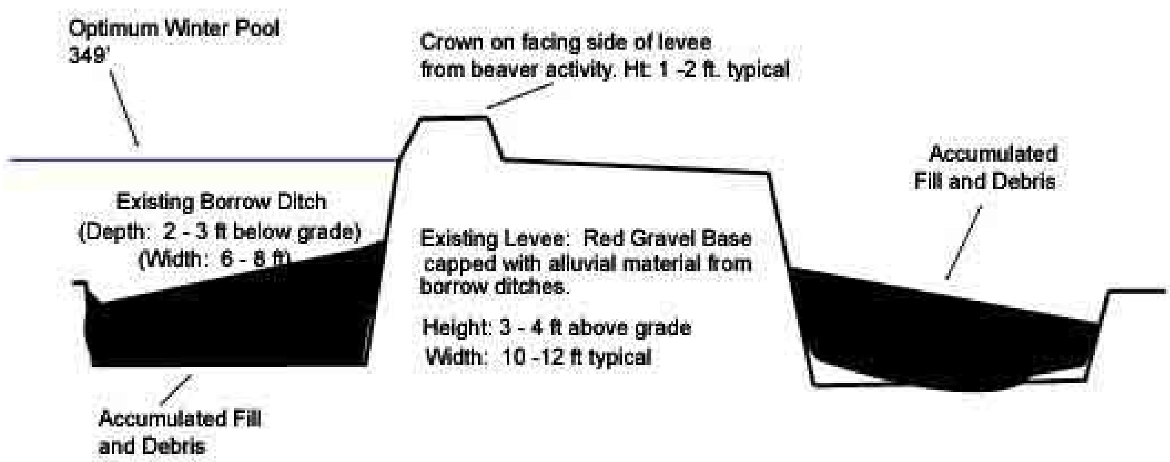


AERIAL SHOWING PRE-EXISTING STRUCTURES

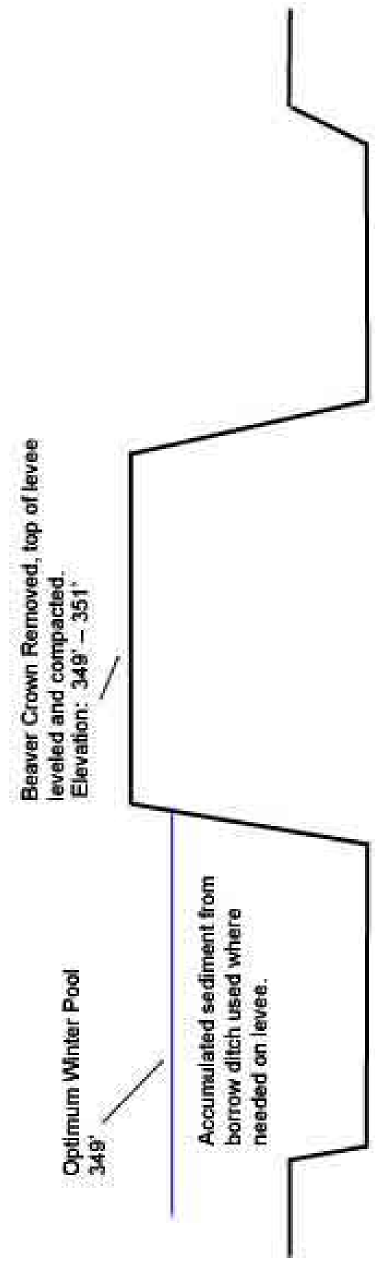


AERIAL LOCATION MAP OF CONSTRUCTION COMPLETED IN 2008

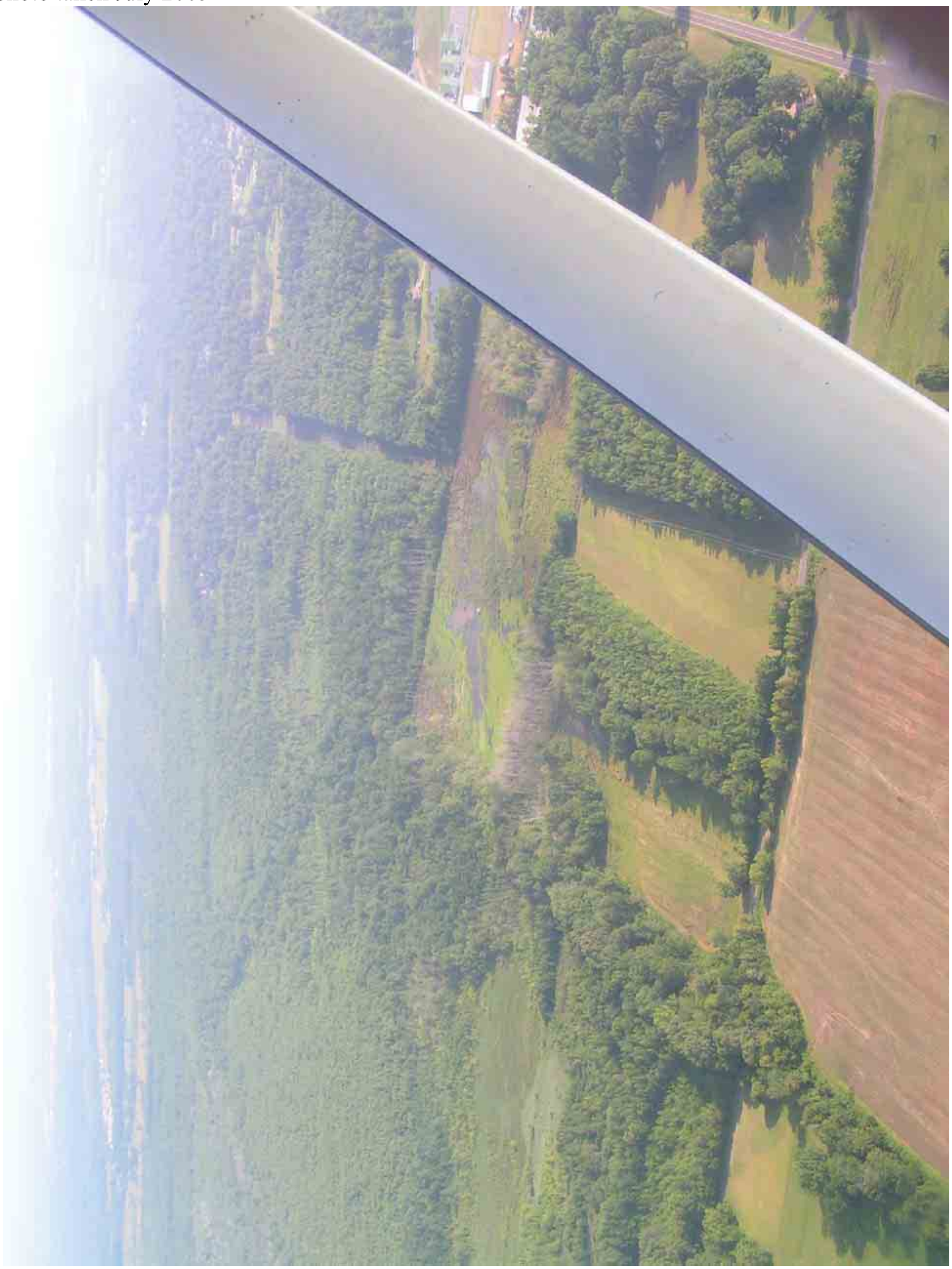
Cross Section of Existing East/West Levee Before Construction



Cross Section of East/West Levee after Construction (Typical)



Aerial photo taken July 2005



INDICATOR CHECKLIST

INDICATOR	PRESENT	ABSENT
Microtopographic relief	✓	
Overbank flooding	✓	
Sediment scour and deposition	✓	
Redistribution of detritus	✓	
Localized sediment deposition	✓	
Structural roughness	✓	
Presence of debris dams and wrack	✓	
Intermediate soil porosity W4 43.5	✓	
Reduced soil conditions	✓	
Low permeability soils		
Saturated soils unrelated to overbank flow	✓	
Seeps at upland/wetland interface or at wetland surface	✓	
Floodplain ponding	✓	
Sparse herbaceous growth in depressions	✓	
Submerged aquatic vegetation	✓	
Obligate wetland vegetation dominates	✓	
Vegetative community typical of "reference" (impact) site	✓	
Surface films or layers of recently deposited sediments	✓	
Debris dams in active channels	✓	
Debris dams in side channels	✓	
Debris accumulations in microtopographic depressions	✓	
Debris accumulations in vegetation	✓	
Debris redistribution off-site	✓	

Indicators of function

- ✓ Microtopographic relief (e.g. hummocks, scour around trees, small surface channels) [Microtopographic relief occurs on the order of a few meters or less, such as pit-and-mound features from windthrow, hummocks, buttressing of trees, large logs, etc.]

- ✓ Overbank flooding (direct observation or indirect evidence such as water, aerial photographs, or gage data)

- ✓ Sediment scour and deposition

- ✓ Redistribution of detritus (e.g., wrack, debris jams, drift lines)

- ✓ Localized sediment deposition

- ✓ Structural roughness (e.g., vegetation, microtopographic relief)

- ✓ Presence of debris jams and wrack

- ✓ Intermediate soil porosity:

  Sediments must be capable of developing unsaturated pore space in order to have the capacity to store water. (Fine-grained soils with low transmissivity function poorly in subsurface storage of water because of their resistance to infiltration and because they maintain thick capillary fringes that don't develop adequate unsaturated volume for subsurface storage).

- ✓ Reduced soil conditions (e.g., mottling, gleying, organic matter accumulation, redox potential, etc.) Contributes to the maintenance of hydric soils, anaerobic biogeochemistry, and plant and animal species composition adapted to life in reduced conditions.

- ✓ Saturated soils unrelated to overbank flooding (i.e., maintained in spite of the lack of precipitation and overbank flooding). Groundwater discharge originating upslope may maintain saturation when other supplies cease.

- ✓ Seeps at upland/wetland interface or at surface of wetland (such seeps are indicative of water moving vertically upward)

- ✓ Floodplain ponding (direct observation or indirect evidence)

- ✓ Sparse herbaceous growth in depressions

- ✓ Low permeability soils

- ✓ Vegetation indicative of standing water (for example, submerged aquatic and/or obligate emergents)

- ✓ Vegetative community (density, basal area, vertical stratification, cover, and species composition) typical of reference site with evidence of nutrient uptake and release (plant growth, litter production, decomposition rate, etc.)

- ✓ Surface films or layers of recently deposited sediments

- ✓ Debris blockages in active channels, blockages in side channels, accumulations in microtopographic depressions, accumulations in vegetation, redistribution off-site

WAVERLY SERIES

The Waverly series consists of nearly level, very deep, poorly drained soils that have moderate permeability. These soils are on floodplains of streams that drain the Southern Mississippi Valley Silty Uplands Major Land Resource Area and on alluvial fans along the eastern edge of the Southern Mississippi Valley Alluvium Major Land Resource Area. They formed in silty alluvium derived from loess. Slopes range from 0 to 2 percent.

TAXONOMIC CLASS: Coarse-silty, mixed, active, acid, thermic Fluvaquentic Endoaquepts

TYPICAL PEDON: Waverly silt loam - cultivated. (Colors are for moist soil unless otherwise stated.)

Ap--0 to 5 inches; grayish brown (10YR 5/2) silt loam; weak fine granular structure; friable; common fine roots; few fine brown iron-manganese concretions; strongly acid; abrupt smooth boundary. (3 to 10 inches thick)

Bg1--5 to 14 inches; light gray (10YR 7/1) silt loam; few medium distinct pale brown (10YR 6/3) masses of oxidized iron along root channels; moderate medium subangular blocky structure; friable; common fine roots; few fine brown iron-manganese concretions; strongly acid; clear wavy boundary.

Bg2--14 to 25 inches; light gray (10YR 7/1) silt loam; common medium distinct yellowish brown (10YR 5/6) masses of oxidized iron; weak medium subangular blocky structure; friable; common reddish brown coatings; common fine and medium black and brown iron-manganese concretions; few fine black soft masses of iron-manganese concentrations; strongly acid; clear wavy boundary.

Bg3--25 to 40 inches; light gray (10YR 7/1) silt loam; few medium distinct dark yellowish brown (10YR 4/4) masses of oxidized iron; weak medium subangular blocky structure; friable; few black and brown iron-manganese concretions; common fine and medium black soft masses of iron-manganese concentrations; strongly acid; gradual wavy boundary. (Combined thickness of the Bg horizon is 24 to 46 inches.)

Bg4--40 to 60 inches; variegated light gray (10YR 7/1), light brownish gray (10YR 6/2) and dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; common brown coatings; few fine pieces of charcoal; few black and brown iron-manganese concretions; common fine black soft masses of iron-manganese concentrations; strongly acid; gradual wavy boundary.

BCg--60 to 80 inches; variegated light gray (10YR 7/1), light brownish gray (10YR 6/2) and dark yellowish brown (10YR 4/4) silty clay loam; weak medium subangular blocky structure; friable; common brown coatings; few fine pieces of charcoal; few black and brown iron-manganese concretions; common fine black soft masses of iron-manganese concentrations; strongly acid.

TYPE LOCATION: Tallahatchie County, Mississippi; 2.5 miles west of intersection of State Highway 35 on State Highway 32, 0.45 mile south on gravel road, 0.2 mile west in field road and 500 feet south of barn foundation. NE1/4SW1/4 sec. 5, R. 2 E., T. 24 N.; Latitude 33 degrees 58 minutes 45.37 seconds N. and Longitude 90 degrees 6 minutes 47.93 seconds W., Paynes USGS 7.5 Minute Quadrangle, Mississippi.

RANGE IN CHARACTERISTICS: The solum is greater than 24 inches thick. The soil is very strongly acid or strongly acid, except where the surface layer has been limed. Brown and black concretions are few to many throughout the solum. The 10- to 40-inch control section has 5 to 18 percent clay.

The Ap or the A horizon has hue of 10YR, value of 4 to 6, and chroma of 1 to 4. It is silt, silt loam, or very fine sandy loam.

The Bg horizon has hue of 10YR, 2.5Y, or 5Y, value of 6 or 7, and chroma of 1 or 2, or value of 4 or 5 and chroma of 1; masses of ozidized iron in shades of yellow or brown are few to common. Texture is silt or silt loam.

The BCg or Cg horizon has the same range in color as the Bg horizon. Textures are silt, silt loam, or silty clay loam.

Some pedons have a buried A and B horizon below a depth of 20 inches.

COMPETING SERIES: This is the Falaya series in the same family. Closely related series in other families are the Arkabutla, Bibb, Convent, Gillsburg, Kinston, Mantachie, Mhoon, and Rosebloom series. Arkabutla, Kinston, and Mantachie soils have a fine-loamy particle-size class; also, Arkabutla soils have higher chroma in the upper part of the B horizon, and Kingston and Mantachie soils have siliceous mineralogy. Bibb soils have a coarse-loamy particle-size class and siliceous mineralogy. Convent, Falaya, and Gillsburg soils have a subhorizon with higher chroma in the upper part of the B horizon; also, Convent soils have a nonacid reaction class and formed entirely in Mississippi River alluvium. Mhoon and Rosebloom soils have a fine-silty particle-size class; also, Mhoon soils have a nonacid reaction class and formed entirely in Mississippi River alluvium.

GEOGRAPHIC SETTING: These soils are on flood plains and alluvial fans. Slope gradients mainly are less than 1 percent but range to 2 percent along streams that drain the Southern Mississippi Valley Silty Uplands Major Land Resource Area. Waverly soils formed in silty alluvium derived mainly from loess of low sand content. The climate is warm and humid. Average annual temperature is about 65 degrees Fahrenheit, and average annual precipitation is about 54 inches near the type location.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the closely related Falaya and Rosebloom soils, and Collins soils. The somewhat poorly drained Falaya soils are on slightly higher parts of the floodplain, and the poorly drained Rosebloom soils are in similar positions as the Waverly soils. Themoderately well drained Collins soils, are on slightly higher flood plain positions near channels, bedding planes in the upper 20 inches and do not have a cambic horizon.

DRAINAGE AND PERMEABILITY: Poorly drained, slow runoff; moderate permeability. Areas in depressions are ponded during wet seasons. The water table is at or within one foot of the surface during the winter and spring months in normal years. These soils are subject to occasional or frequent flooding for brief to long duration after heavy rainfall.

USE AND VEGETATION: Most areas of the Waverly soils are in bottomland hardwoods. Principal trees are sweetgum, cherrybark oak, willow oak, water oak, nutall oak, pin oak, eastern cottonwood, American sycamore, loblolly pine, water tupelo and cypress. Cleared areas are used for growing cotton, corn, soybeans, hay crops or pasture.

DISTRIBUTION AND EXTENT: Arkansas, Kentucky, Louisiana, Mississippi, Missouri, and Tennessee. The series is of large extent.

MLRA OFFICE RESPONSIBLE: Little Rock, Arkansas

SERIES ESTABLISHED: Union County, Kentucky; 1902.

REMARKS: The Waverly series has been updated to include the presence of a cambic horizon. Also, active CE activity class is recognized.

Diagnostic horizons and features recognized in this pedon are:
Ochric epipedon - The zone from the surface to a depth of about 5 inches (Ap horizon).
Cambic horizon - The zone from 5 to 80 inches (Bg1, Bg2, Bg3, Bg4, BCg horizons).
Aquic conditions - saturation, reduction and redoximorphic features, including gleyed matrix between 5 and 30 inches deep (Bg1, Bg2, Bg3 horizons).
Irregular organic carbon distribution - The zone from 5 to 50 inches deep (Bg and BCg horizons).

Water Features

This table gives estimates of various soil water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

Surface runoff refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. The concept indicates relative runoff for very specific conditions. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are negligible, very low, low, medium, high, and very high.

The *months* in the table indicate the portion of the year in which a water table, ponding, and/or flooding is most likely to be a concern.

Water table refers to a saturated zone in the soil. The water features table indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

Ponding is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The table indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

Flooding is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

Duration and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Report—Water Features

Water Features– Calloway and Marshall Counties, Kentucky										
Map unit symbol and soil name	**Hydrologic group**	**Surface runoff**	**Month**	**Water table**		**Ponding**			**Flooding**	
				Upper limit	**Lower limit**	**Surface depth**	**Duration**	**Frequency**	**Duration**	**Frequency**
				Ft	*Ft*	*Ft*				
Wa—Waverly silt loam										
Waverly	B/D	Very low	January	0.0-1.0	>6.0	—	—	None	Brief	Occasional
	B/D	Very low	February	0.0-1.0	>6.0	—	—	None	Brief	Occasional
	B/D	Very low	March	0.0-1.0	>6.0	—	—	None	Brief	Occasional
	B/D	Very low	April	0.0-1.0	>6.0	—	—	None	Brief	Occasional
	B/D	Very low	May	0.0-1.0	>6.0	—	—	None	Brief	Occasional
	B/D	Very low	December	0.0-1.0	>6.0	—	—	None	Brief	Occasional

Data Source Information

Soil Survey Area: Calloway and Marshall Counties, Kentucky
Survey Area Data: Version 6, Oct 9, 2009

Hydric Soils

This table lists the map unit components that are rated as hydric soils in the survey area. This list can help in planning land uses; however, onsite investigation is recommended to determine the hydric soils on a specific site (National Research Council, 1995; Hurt and others, 2002).

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and wetland hydrology (Cowardin and others, 1979; U.S. Army Corps of Engineers, 1987; National Research Council, 1995; Tiner, 1985). Criteria for all of the characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register, 1994). These soils, under natural conditions, are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. In order to determine whether a specific soil is a hydric soil or nonhydric soil, however, more specific information, such as information about the depth and duration of the water table, is needed. Thus, criteria that identify those estimated soil properties unique to hydric soils have been established (Federal Register, 2002). These criteria are used to identify map unit components that normally are associated with wetlands. The criteria used are selected estimated soil properties that are described in "Soil Taxonomy" (Soil Survey Staff, 1999) and "Keys to Soil Taxonomy" (Soil Survey Staff, 2006) and in the "Soil Survey Manual" (Soil Survey Division Staff, 1993).

If soils are wet enough for a long enough period of time to be considered hydric, they should exhibit certain properties that can be easily observed in the field. These visible properties are indicators of hydric soils. The indicators used to make onsite determinations of hydric soils are specified in "Field Indicators of Hydric Soils in the United States" (Hurt and Vasilas, 2006).

Hydric soils are identified by examining and describing the soil to a depth of about 20 inches. This depth may be greater if determination of an appropriate indicator so requires. It is always recommended that soils be excavated and described to the depth necessary for an understanding of the redoximorphic processes. Then, using the completed soil descriptions, soil scientists can compare the soil features required by each indicator and specify which indicators have been matched with the conditions observed in the soil. The soil can be identified as a hydric soil if at least one of the approved indicators is present.

Map units that are dominantly made up of hydric soils may have small areas, or inclusions, of nonhydric soils in the higher positions on the landform, and map units dominantly made up of nonhydric soils may have inclusions of hydric soils in the lower positions on the landform.

The criteria for hydric soils are represented by codes in the table (for example, 2B3). Definitions for the codes are as follows:

1. All Histels except for Folistels, and Histosols except for Folists.
2. Soils in Aquic suborders, great groups, or subgroups, Albolls suborder, Historthels great group, Histoturbels great group, or Andic, Cumulic, Pachic, or Vitrandic subgroups that:
   A. are somewhat poorly drained and have a water table at the surface (0.0 feet) during the growing season, or
   B. are poorly drained or very poorly drained and have either:
      i. a water table at the surface (0.0 feet) during the growing season if textures are coarse sand, sand, or fine sand in all layers within a depth of 20 inches, or
      ii. a water table at a depth of 0.5 foot or less during the growing season if saturated hydraulic conductivity (Ksat) is equal to or greater than 6.0 in/hr in all layers within a depth of 20 inches, or
      iii. a water table at a depth of 1.0 foot or less during the growing season if saturated hydraulic conductivity (Ksat) is less than 6.0 in/hr in any layer within a depth of 20 inches.
3. Soils that are frequently ponded for long or very long duration during the growing season.
4. Soils that are frequently flooded for long or very long duration during the growing season.

References:

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. September 18, 2002. Hydric soils of the United States.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18.

Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service.

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

Report—Hydric Soils

Hydric Soils– Calloway and Marshall Counties, Kentucky				
Map symbol and map unit name	**Component**	**Percent of map unit**	**Landform**	**Hydric criteria**
Wa—Waverly silt loam				
	Waverly	90	Flood plains, drainageways	2B3
	Bibb	3	Flood plains, drainageways	2B3

Data Source Information

Soil Survey Area: Calloway and Marshall Counties, Kentucky
Survey Area Data: Version 6, Oct 9, 2009

Chemical Soil Properties

This table shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Effective cation-exchange capacity refers to the sum of extractable cations plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5.

Soil reaction is a measure of acidity or alkalinity. It is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced saturated hydraulic conductivity and aeration, and a general degradation of soil structure.

Report—Chemical Soil Properties

Chemical Soil Properties– Calloway and Marshall Counties, Kentucky								
Map symbol and soil name	**Depth**	**Cation-exchange capacity**	**Effective cation-exchange capacity**	**Soil reaction**	**Calcium carbonate**	**Gypsum**	**Salinity**	**Sodium adsorption ratio**
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
Wa—Waverly silt loam								
Waverly	0-9	—	1.3-5.3	4.5-5.5	0	0	0	0
	9-60	—	2.9-8.4	4.5-5.5	0	0	0	0

Data Source Information

Soil Survey Area: Calloway and Marshall Counties, Kentucky
Survey Area Data: Version 6, Oct 9, 2009

Map Unit Description

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. All the soils of a series have major horizons that are similar in composition, thickness, and arrangement. Soils of a given series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Additional information about the map units described in this report is available in other soil reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the soil reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description

Calloway and Marshall Counties, Kentucky

Wa—Waverly silt loam

Map Unit Setting

Mean annual precipitation: 52 to 62 inches
Mean annual air temperature: 48 to 69 degrees F
Frost-free period: 182 to 210 days

Map Unit Composition

Waverly and similar soils: 90 percent
Minor components: 10 percent

Description of Waverly

Setting

Landform: Flood plains, drainageways
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Coarse-silty alluvium

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water capacity: Very high (about 12.6 inches)

Interpretive groups

Land capability (nonirrigated): 3w

Typical profile

0 to 9 inches: Silt loam
9 to 60 inches: Silt loam

Minor Components

Falaya

Percent of map unit: 4 percent

Bibb

Percent of map unit: 3 percent
Landform: Flood plains, drainageways
Down-slope shape: Linear
Across-slope shape: Linear

Mantachie

Percent of map unit: 3 percent

Data Source Information

Soil Survey Area: Calloway and Marshall Counties, Kentucky
Survey Area Data: Version 6, Oct 9, 2009

Particle Size and Coarse Fragments

This table shows estimates of particle size distribution and coarse fragment content of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Total fragments is the content of fragments of rock and other materials larger than 2 millimeters in diameter on volumetric basis of the whole soil.

Fragments 2-74 mm refers to the content of coarse fragments in the 2 to 74 millimeter size fraction.

Fragments 75-249 mm refers to the content of coarse fragments in teh 75 to 249 millimeter size fraction.

Fragments 250-599 mm refers to the content of coarse fragments in the 250 to 599 millimeter size fraction.

Fragments >=600 mm refers to the content of coarse fragments in the greater than or equal to 600 millimeter size fraction.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Report—Particle Size and Coarse Fragments

Particle Size and Coarse Fragments– Calloway and Marshall Counties, Kentucky																					
Map symbol and soil name	**Horizon**	**Depth**	**Sand**	**Silt**	**Clay**	**Total fragments**	**Fragments 2-74 mm**	**Fragments 75-249 mm**	**Fragments 250-599 mm**	**Fragments >=600 mm**			*In*	*Pct*	*Pct*	*Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*
Wa—Waverly silt loam																					
Waverly	H1	0-9	—	—	6-12 -18	—	—	—	—	—											
	H2	9-60	—	—	10-14 -18	—	—	—	—	—											

Data Source Information

Soil Survey Area: Calloway and Marshall Counties, Kentucky
Survey Area Data: Version 6, Oct 9, 2009

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Report—Physical Soil Properties

Physical Soil Properties– Calloway and Marshall Counties, Kentucky														
Map symbol and soil name	**Depth**	**Sand**	**Silt**	**Clay**	**Moist bulk density**	**Saturated hydraulic conductivity**	**Available water capacity**	**Linear extensibility**	**Organic matter**	**Erosion factors**			**Wind erodibility group**	**Wind erodibility index**
										Kw	**Kf**	**T**		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
Wa—Waverly silt loam														
Waverly	0-9	-21-	-67-	6-12- 18	1.40-1.50	4.23-14.11	0.20-0.22	0.0-2.9	1.0-3.0	.43	.43	5	8	0
	9-60	-14-	-72-	10-14- 18	1.40-1.55	4.23-14.11	0.20-0.22	0.0-2.9	0.0-0.5	.43	.43			

Data Source Information

Soil Survey Area: Calloway and Marshall Counties, Kentucky
Survey Area Data: Version 6, Oct 9, 2009

Taxonomic Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1999 and 2003). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. This table shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol.* An example is Alfisols.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalfs (*Ud*, meaning humid, plus *alfs*, from Alfisols).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalfs*, the suborder of the Alfisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, active, mesic Typic Hapludalfs.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

References:
Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.
Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. (The soils in a given survey area may have been classified according to earlier editions of this publication.)

Report—Taxonomic Classification of the Soils

[An asterisk by the soil name indicates a taxadjunct to the series]

Taxonomic Classification of the Soils– Calloway and Marshall Counties, Kentucky	
Soil name	**Family or higher taxonomic classification**
Waverly	Coarse-silty, mixed, active, acid, thermic Fluvaquentic Endoaquepts

Data Source Information

Soil Survey Area: Calloway and Marshall Counties, Kentucky
Survey Area Data: Version 6, Oct 9, 2009

M — MARINE

SUBSYSTEM: 1 — SUBTIDAL

CLASS	RB — ROCK BOTTOM	UB — UNCONSOLIDATED BOTTOM	AB — AQUATIC BED	RF — REEF	OW — *OPEN WATER/ Unknown Bottom*
Subclass	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Algal 3 Rooted Vascular 5 *Unknown Submergent*	1 Coral 3 Worm	

SUBSYSTEM: 2 — INTERTIDAL

CLASS	AB — AQUATIC BED	RF — REEF	RS — ROCKY SHORE	US — UNCONSOLIDATED SHORE
Subclass	1 Algal 3 Rooted Vascular 5 *Unknown Submergent*	1 Coral 3 Worm	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic

E — ESTUARINE

SUBSYSTEM: 1 — SUBTIDAL

CLASS	RB — ROCK BOTTOM	UB — UNCONSOLIDATED BOTTOM	AB — AQUATIC BED	RF — REEF	OW — *OPEN WATER/ Unknown Bottom*
Subclass	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Algal 3 Rooted Vascular 4 Floating Vascular 5 *Unknown Submergent* 6 *Unknown Surface*	2 Mollusc 3 Worm	

SUBSYSTEM: 2 — INTERTIDAL

CLASS	AB — AQUATIC BED	RF — REEF	SB — STREAMBED	RS — ROCKY SHORE	US — UNCONSOLIDATED SHORE	EM — EMERGENT	SS — SCRUB-SHRUB	FO — FORESTED
Subclass	1 Algal 3 Rooted Vascular 4 Floating Vascular 5 *Unknown Submergent* 6 *Unknown Surface*	2 Mollusc 3 Worm	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Persistent 2 Nonpersistent	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 *Deciduous* 7 *Evergreen*	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 *Deciduous* 7 *Evergreen*

R — RIVERINE

SUBSYSTEM: 1 — TIDAL; 2 — LOWER PERENNIAL; 3 — UPPER PERENNIAL; 4 — INTERMITTENT; 5 — UNKNOWN PERENNIAL

CLASS	RB — ROCK	UB — UNCONSOLIDATED BOTTOM	*SB — STREAMBED	AB — AQUATIC BED	RS — ROCKY SHORE	US — UNCONSOLIDATED SHORE	**EM — EMERGENT	OW — *OPEN WATER/ Unknown Bottom*
Subclass	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Bedrock 2 Rubble 3 Cobble-Gravel 4 Sand 5 Mud 6 Organic 7 Vegetated	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular 5 *Unknown Submergent* 6 *Unknown Surface*	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	2 Nonpersistent	

*STREAMBED is limited to TIDAL and INTERMITTENT SUBSYSTEMS, and comprises the only CLASS in the INTERMITTENT SUBSYSTEM.

**EMERGENT is limited to TIDAL and LOWER PERENNIAL SUBSYSTEMS. The remaining CLASSES are found in all SUBSYSTEMS.

L — LACUSTRINE

SUBSYSTEM: 1 — LIMNETIC

CLASS	RB — ROCK BOTTOM	UB — UNCONSOLIDATED BOTTOM	AB — AQUATIC BED	OW — *OPEN WATER/ Unknown Bottom*
Subclass	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular 5 *Unknown Submergent* 6 *Unknown Surface*	

SUBSYSTEM: 2 — LITTORAL

CLASS	RB — ROCK BOTTOM	UB — UNCONSOLIDATED BOTTOM	AB — AQUATIC BED	RS — ROCKY SHORE	US — UNCONSOLIDATED SHORE	EM — EMERGENT	OW — *OPEN WATER/ Unknown Bottom*
Subclass	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular 5 *Unknown Submergent* 6 *Unknown Surface*	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	2 Nonpersistent	

P — PALUSTRINE

CLASS	RB — ROCK BOTTOM	UB — UNCONSOLIDATED BOTTOM	AB — AQUATIC BED	US — UNCONSOLIDATED SHORE	ML — MOSS-LICHEN	EM — EMERGENT	SS — SCRUB-SHRUB	FO — FORESTED	OW — *OPEN WATER/ Unknown Bottom*
Subclass	1 Bedrock 2 Rubble	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic	1 Algal 2 Aquatic Moss 3 Rooted Vascular 4 Floating Vascular 5 *Unknown Submergent* 6 *Unknown Surface*	1 Cobble-Gravel 2 Sand 3 Mud 4 Organic 5 Vegetated	1 Moss 2 Lichen	1 Persistent 2 Nonpersistent	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 *Deciduous* 7 *Evergreen*	1 Broad-Leaved Deciduous 2 Needle-Leaved Deciduous 3 Broad-Leaved Evergreen 4 Needle-Leaved Evergreen 5 Dead 6 *Deciduous* 7 *Evergreen*	

MODIFIERS

In order to more adequately describe wetland and deepwater habitats one or more of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The farmed modifier may also be applied to the ecological system.

WATER REGIME

Non-Tidal

- A Temporarily Flooded
- B Saturated
- C Seasonally Flooded
- D *Seasonally Flooded/ Well Drained*
- E *Seasonally Flooded/ Saturated*
- F Semipermanently Flooded
- G Intermittently Exposed
- H Permanently Flooded
- J Intermittently Flooded
- K Artificially Flooded
- W Intermittently Flooded/Temporary
- Y Saturated/Semipermanent/ Seasonal
- Z Intermittently Exposed/Permanent
- U *Unknown*

Tidal

- K *Artificially Flooded*
- L Subtidal
- M Irregularly Exposed
- N Regularly Flooded
- P Irregularly Flooded
- *S Temporary-Tidal
- *R Seasonal-Tidal
- *T Semipermanent-Tidal
- *V Permanent-Tidal
- U *Unknown*

*These water regimes are only used in tidally influenced, freshwater systems.

WATER CHEMISTRY

Coastal Halinity

- 1 Hyperhaline
- 2 Euhaline
- 3 Mixohaline *(Brackish)*
- 4 Polyhaline
- 5 Mesohaline
- 6 Oligohaline
- 0 Fresh

Inland Salinity

- 7 Hypersaline
- 8 Eusaline
- 9 Mixosaline
- 0 Fresh

pH Modifiers for all Fresh Water

- a Acid
- t Circumneutral
- i Alkaline

SOIL

- g Organic
- n Mineral

SPECIAL MODIFIERS

- b *Beaver*
- d *Partially Drained/Ditched*
- f Farmed
- h *Diked/Impounded*
- r Artificial Substrate
- s *Spoil*
- x Excavated